

Consciousness-Based Education: Using Transcendental Meditation to Enhance Student Learning in Mathematics Classes

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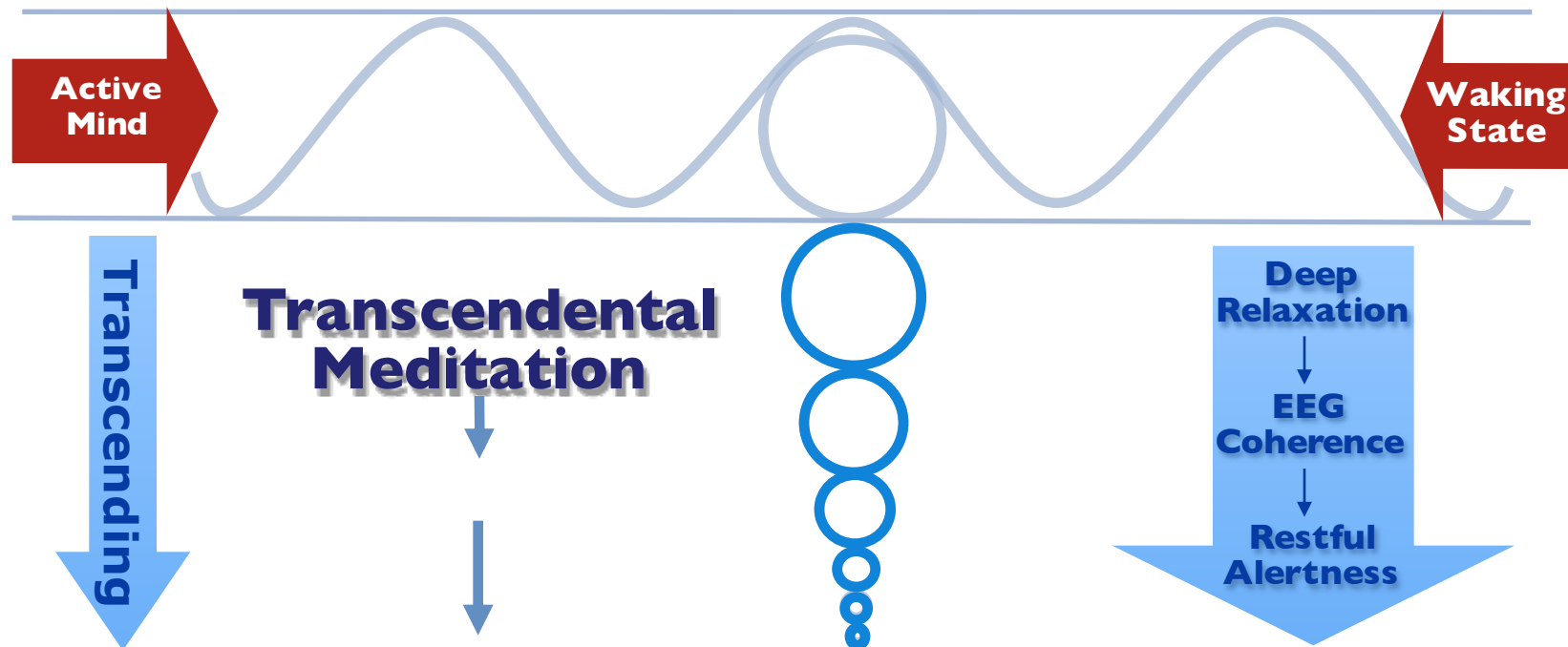


What we do at MUM

- 1. Block system, one course at a time for a month.
- 2. Charts in the classroom connect math topics to larger math principles and to principles of the development of consciousness.
- 3. Regular practice of the Transcendental Meditation technique in the daily routine of students, staff, and faculty.



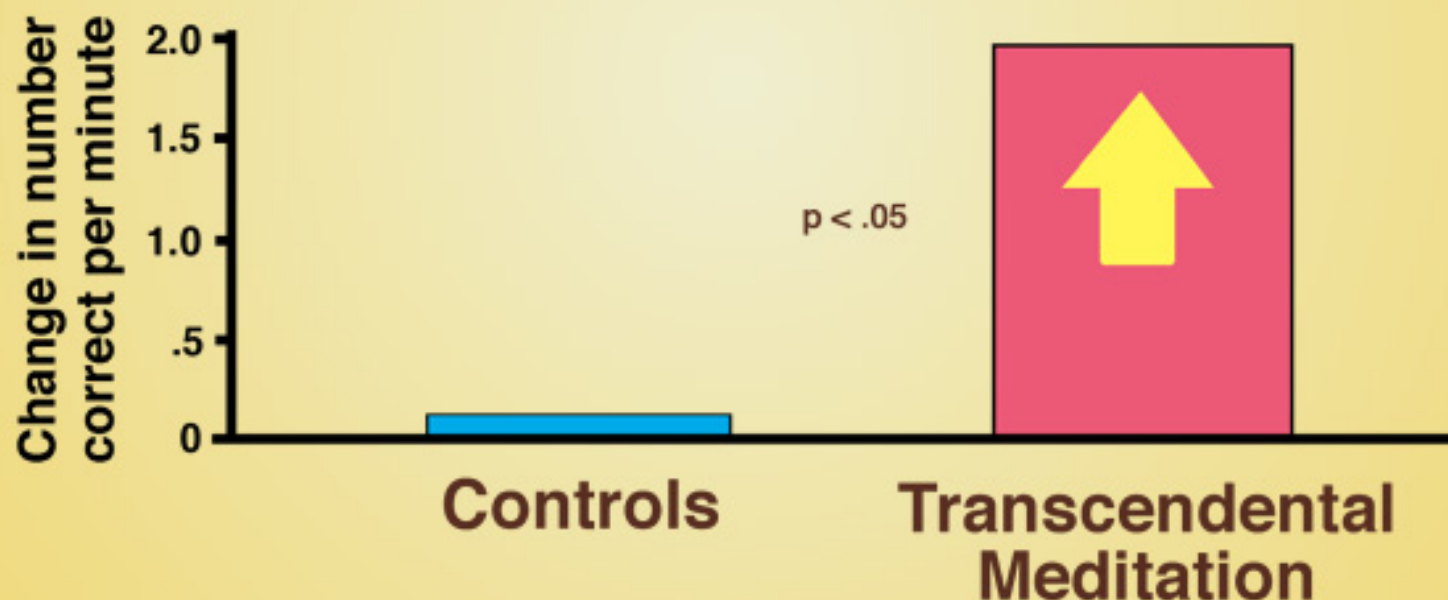
- What is TM?
- Research results
- Explanation of why TM helps doing and learning math



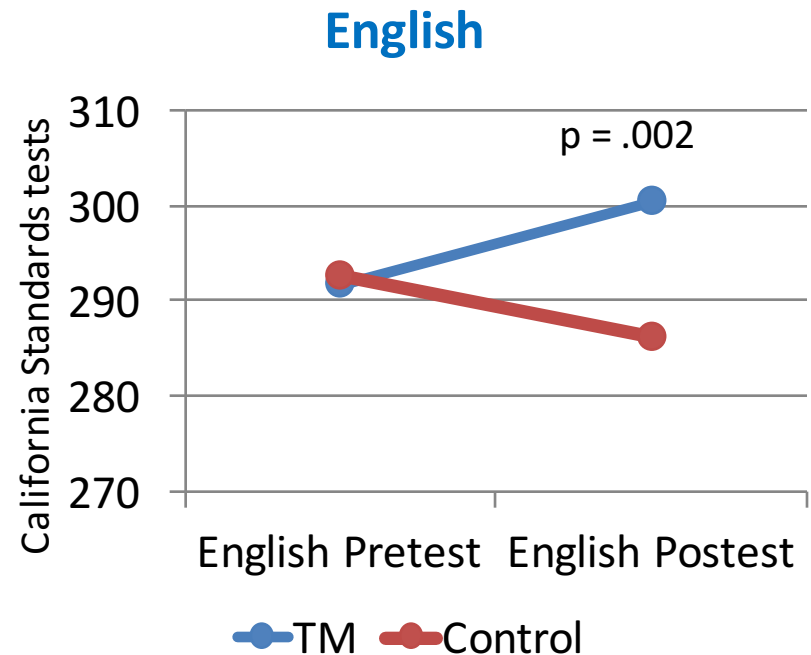
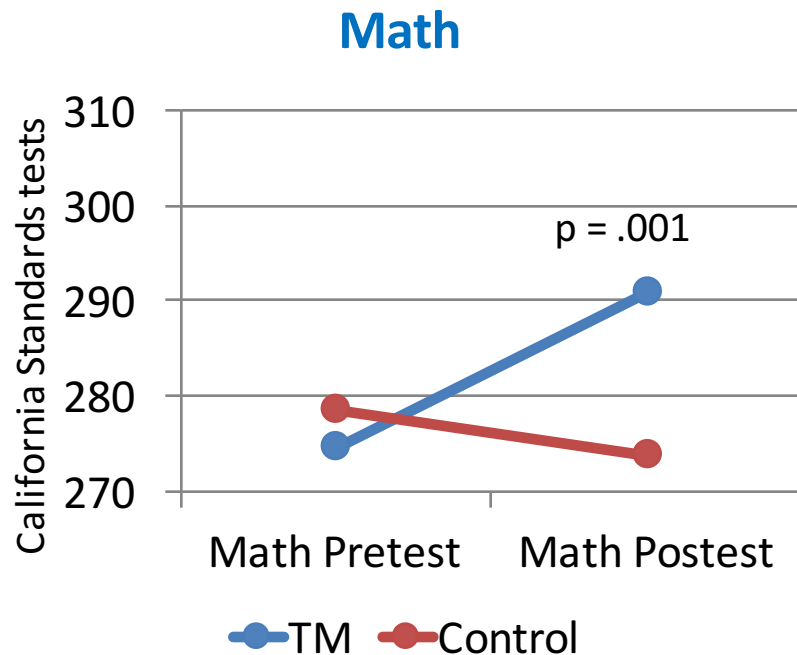
Transcendental Consciousness is the
basis for creative insight

Faster Solution of Arithmetic Problems

THROUGH TRANSCENDENTAL MEDITATION

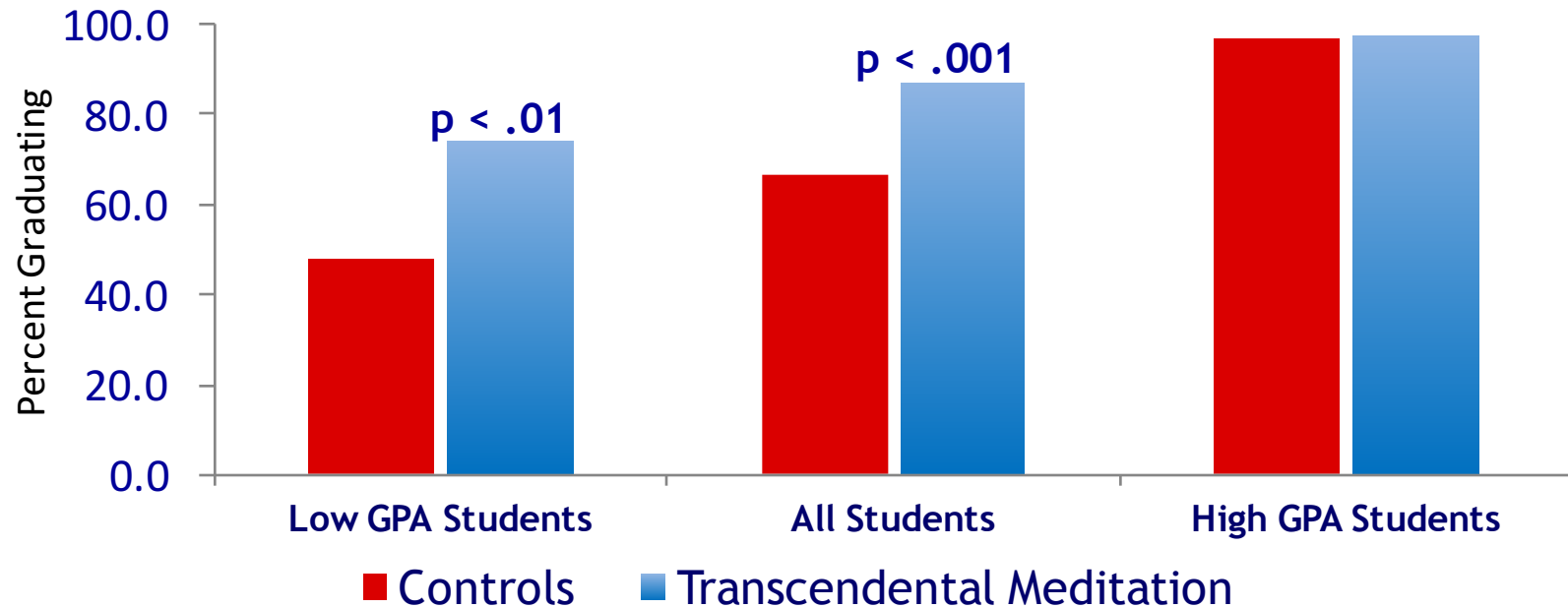


Improved Math and English Scores in Middle School Students



Reference. *Education* 131, no. 3 (2011): 556-64.

Increased Graduation Rate in Secondary School Students

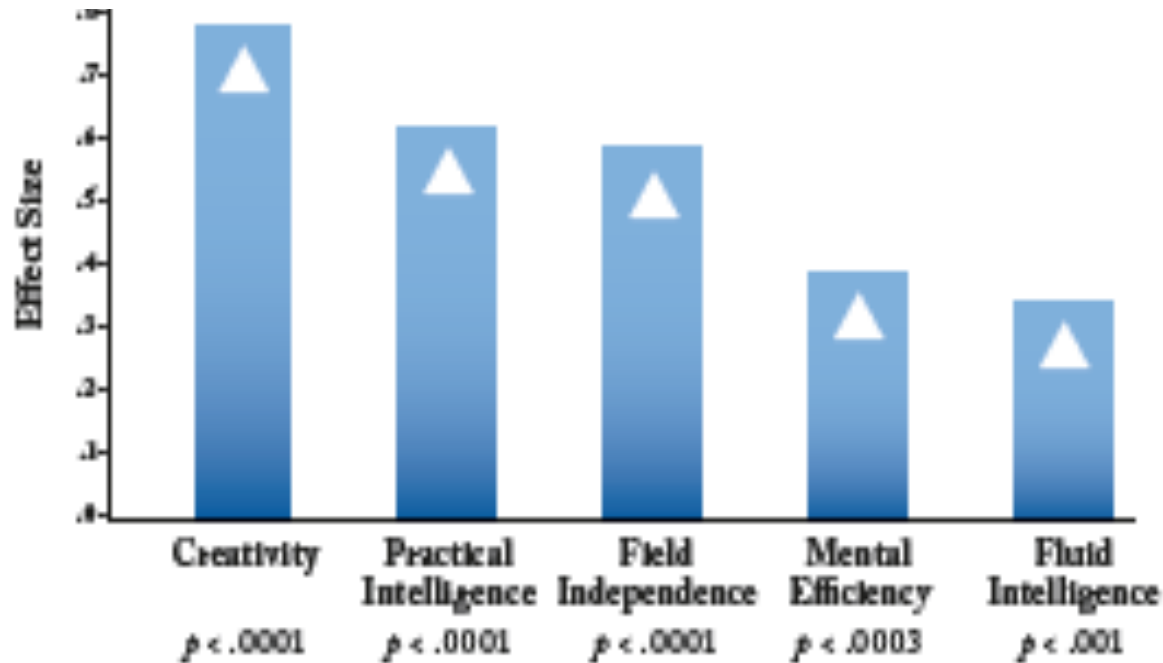


A group of low-performing urban secondary school students who learned the Transcendental Meditation technique and practiced it during their senior year had a higher graduation rate than a control group of students matched for prior academic performance who did not learn the technique.

Reference. *Education* 133(4), 495-501 (2013)

Increased General Cognitive Ability

through the *Transcendental Meditation* technique

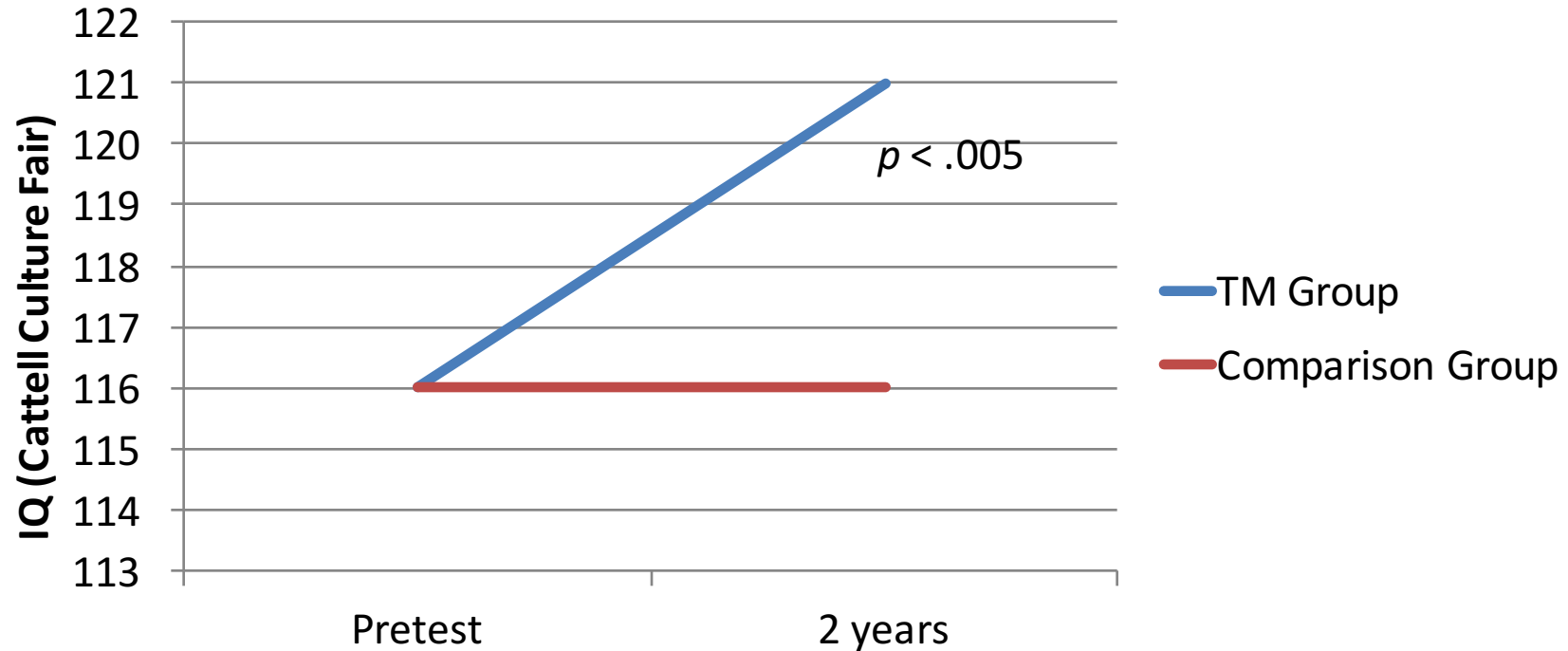


Three randomized controlled studies among secondary school and vocational school students found that, in contrast to controls, those who learned the Transcendental Meditation technique showed significant improvement in five measures of intellectual functioning; they also showed decreased anxiety.

Reference: *Intelligence* 29 (2001): 419–440.

Increased Fluid Intelligence

through the *Transcendental Meditation* technique



A controlled study found that two years of practice of the Transcendental Meditation technique increased fluid intelligence by 5 IQ points in college students. Control subjects who received only the usual college curriculum and not TM training did not change, as expected.

Personality and Individual Differences 12 (1991): 1105-16.

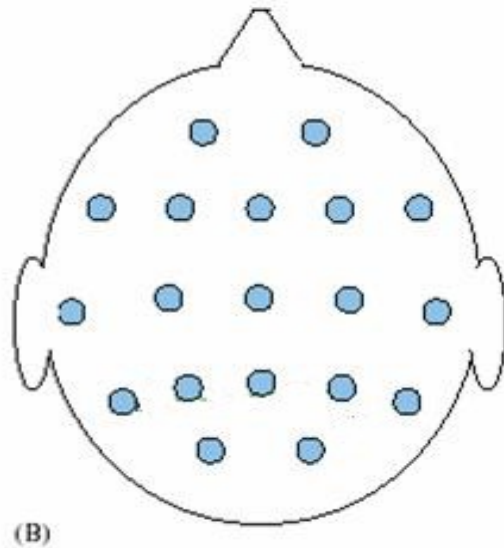
Increased Field Independence Broader Comprehension and Greater Ability to Focus THROUGH TRANSCENDENTAL MEDITATION



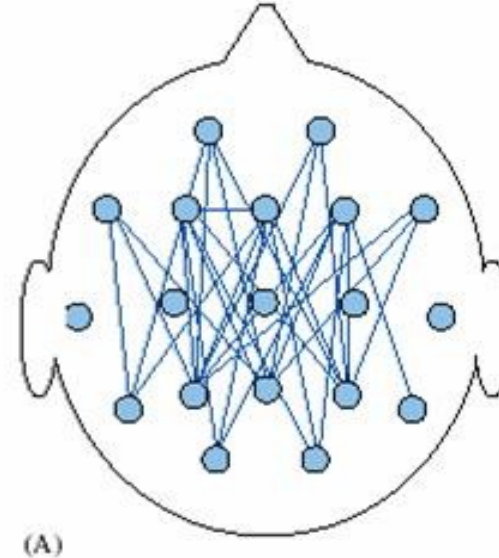
Reference: *Perceptual and Motor Skills* 39: 1031–1034, 1974.

Increased Integration of Brain Functioning through the *Transcendental Meditation* technique

**Control,
Resting Eyes Closed**



**Transcendental
Meditation**



The alpha coherence and synchrony during the TM technique indicates increased long-range integration of brain systems.

Reference. *Signal Processing* 85, no. 11 (2005): 2213-32.
International Journal of Neuroscience 116, no. 12 (2006): 1519-38.
International Journal of Psychophysiology 71, no. 2 (2009): 170-76.

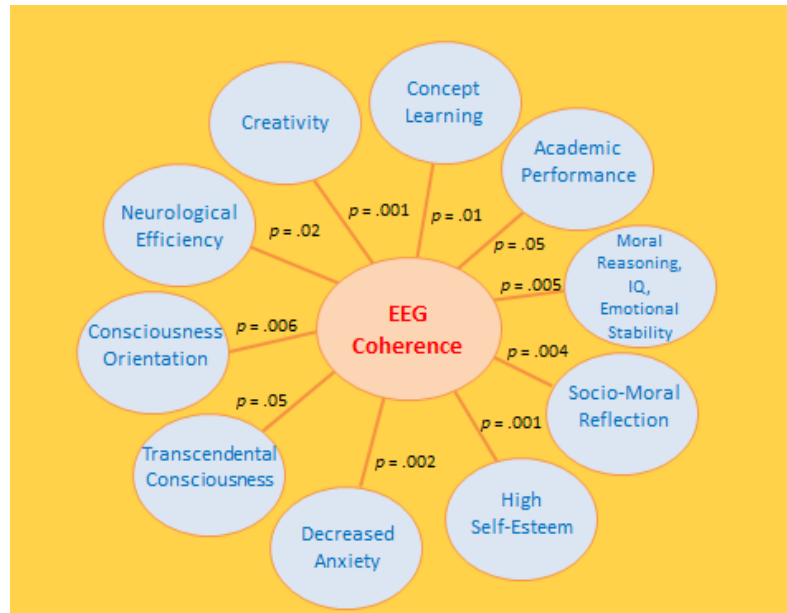
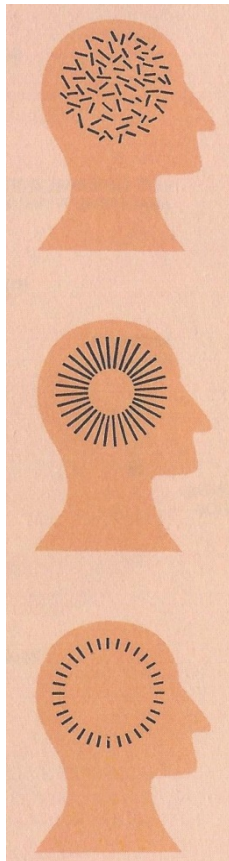
TM and Creative Insight

Research results showing the cognitive and affective correlates of EEG coherence, all relevant to creative insight

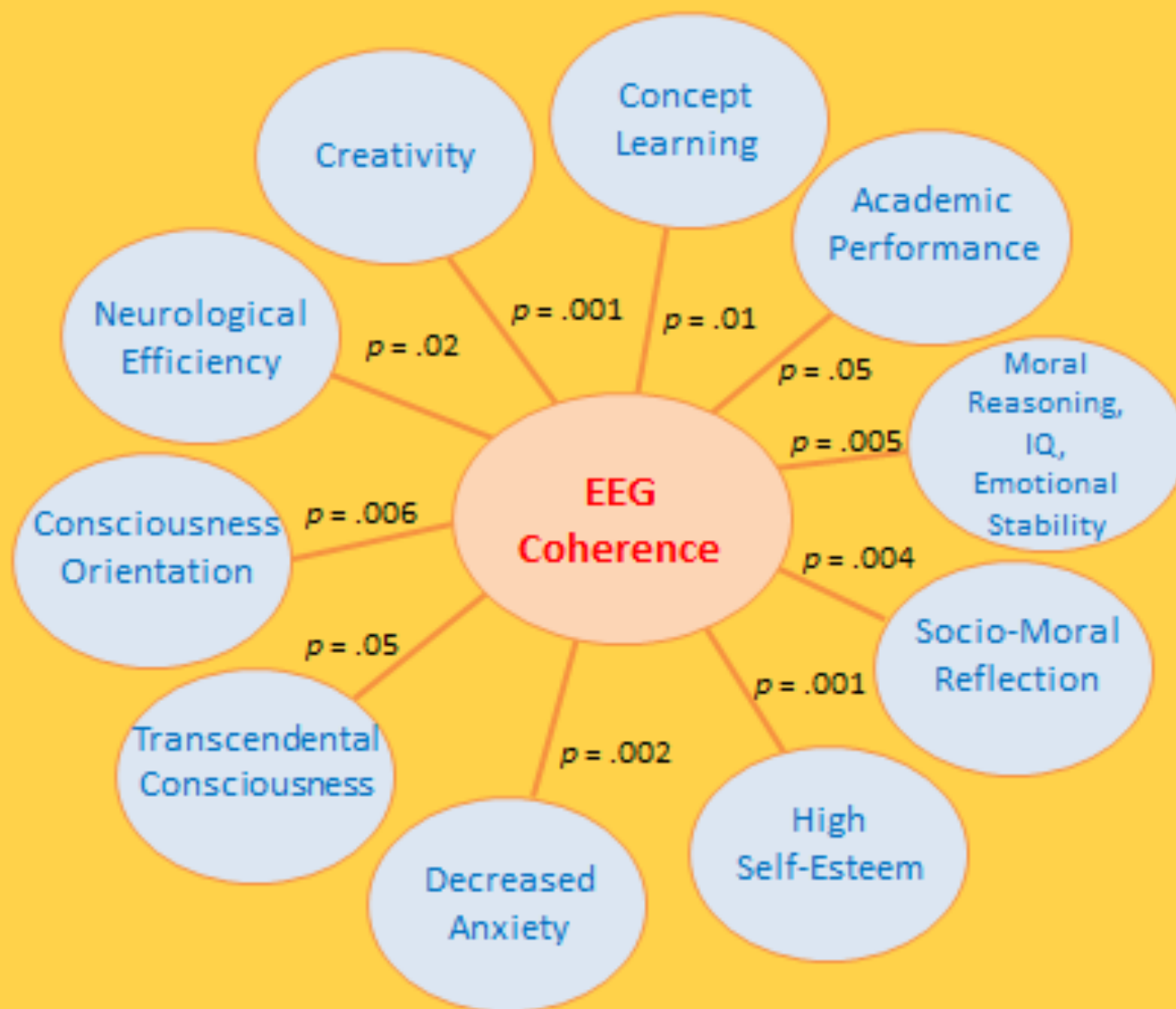
Before TM,
Disordered
Thoughts

During TM,
Pure
Consciousness,
Increased EEG
Coherence

After TM,
Higher
Coherence,
More
Ordered
Thoughts

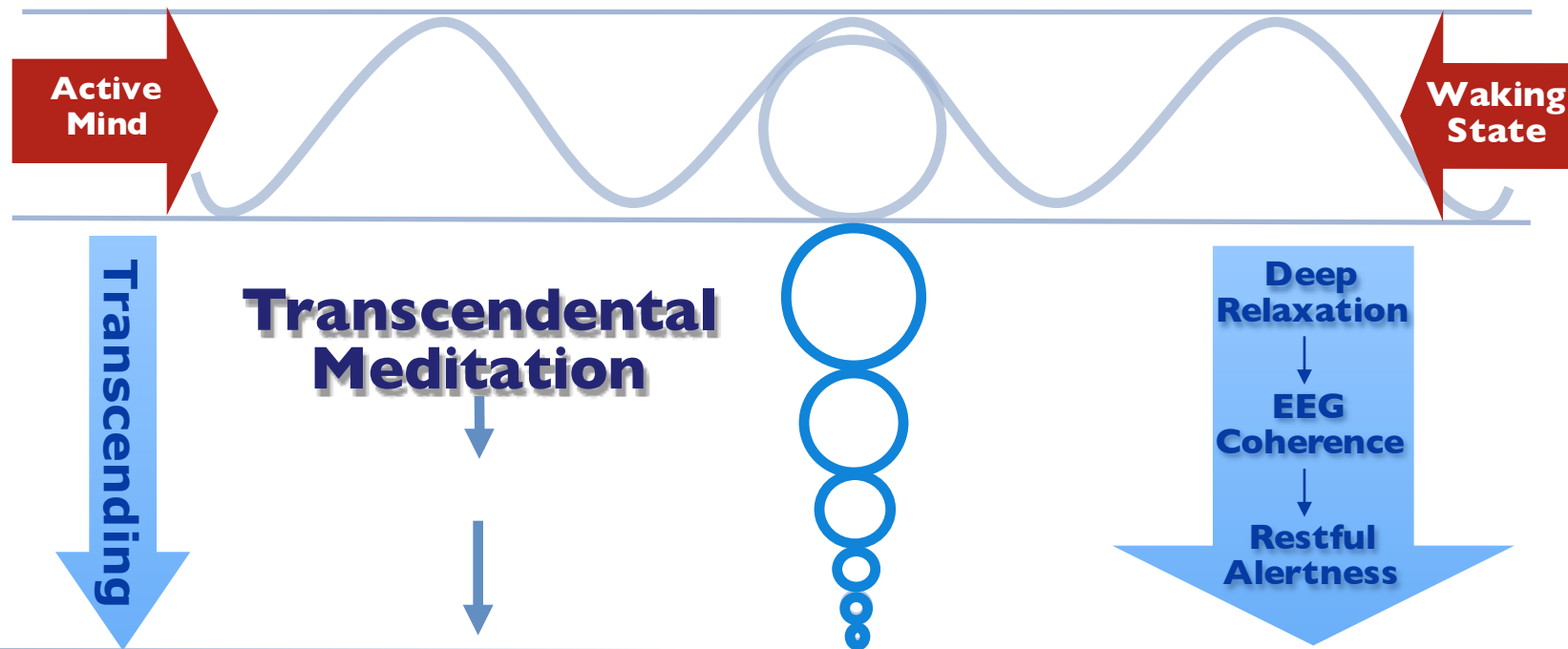


Insight



TM and Creative Insight: Improved Learning and Cognitive Abilities

- TM increases EEG coherence, associated with improved cognitive and emotional functioning.
- TM provides a restfully alert state of coherent brain functioning, a powerful tool for facilitating all kinds of learning and creativity.
- TM increases general cognitive ability, including:
 - a. whole brain creativity
 - b. practical intelligence
 - c. field independence—broad comprehension with ability to focus sharply
 - d. mental efficiency
 - e. fluid intelligence



Transcendental Consciousness is the
basis for creative insight

Deeply integrated process of acquiring mathematical knowledge

Analytic Thinking

- objective
- precision
- details
- symbols
- deductive
- logic
- operations
- rigor
- considered reliable

Intuitive Thinking

- subjective
- immediate
- global
- nonverbal
- synthetic
- self-evident
- self-consistent
- hardly questionable
- considered unreliable

Gaining Knowledge

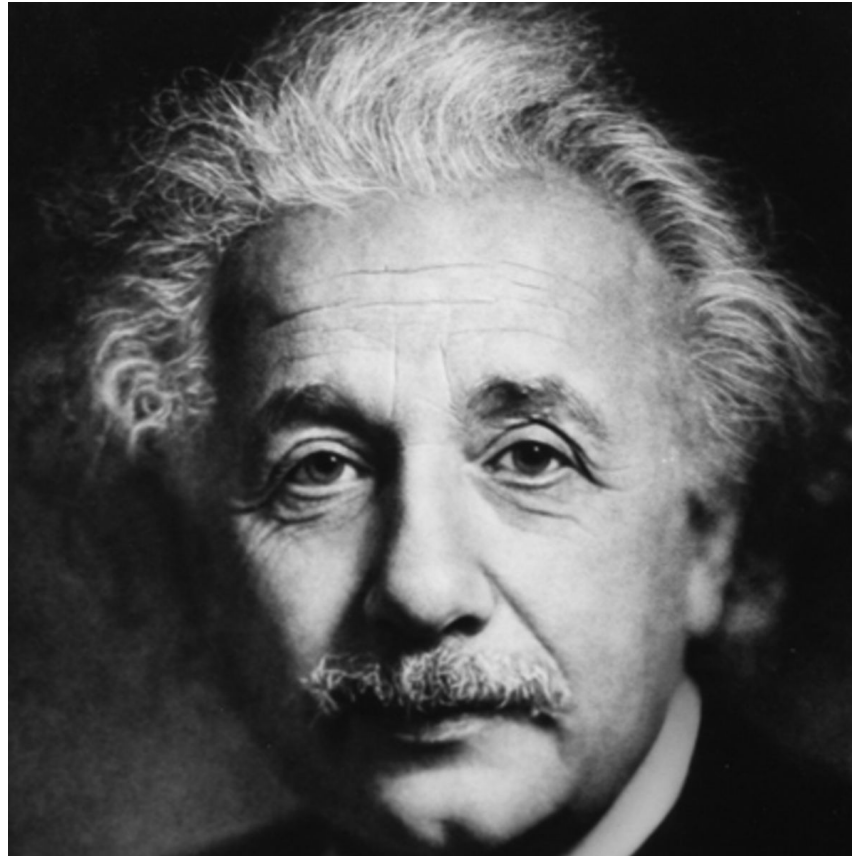
- Piaget:

integrated networks (cognitive schemas) in the brain that are expanded, modified, or replaced when new information is received.

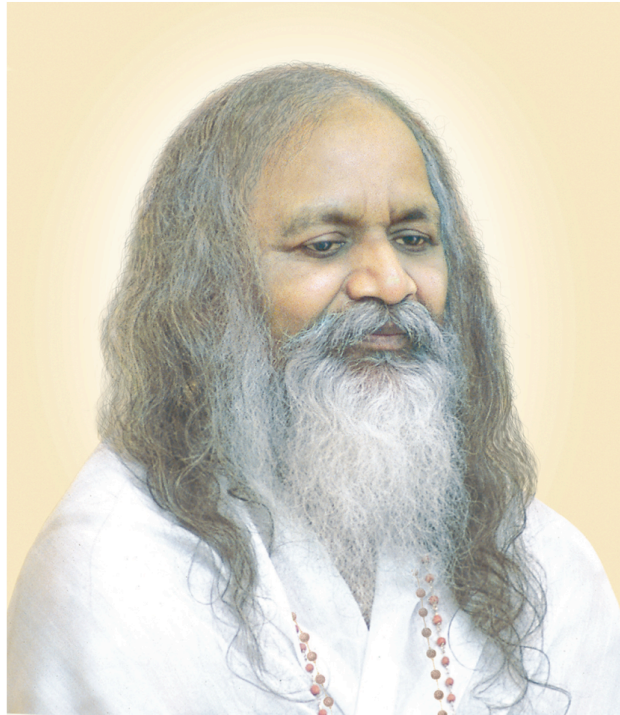
- Constructivism builds on this:

children and all people are not blank slates but create their own learning. People construct their own knowledge and meaning based on their prior knowledge through reflective thought: actively thinking about or mentally working on an idea.

- Silence is also necessary for these connections and integration of new ideas into the old schemas to happen in the mind, in order for schemas to be expanded, modified, changed.



“I think 99 times and find nothing. I stop thinking, swim in silence, and the truth comes to me.” Albert Einstein



The role of education is to develop in students the ability to spontaneously think deeply on quieter levels of the mind, where knowledge is stored. As one's attention goes to the quieter levels of the mind, the quiet, tender, comprehensive level of the mind is enlivened, where deep connections are made.

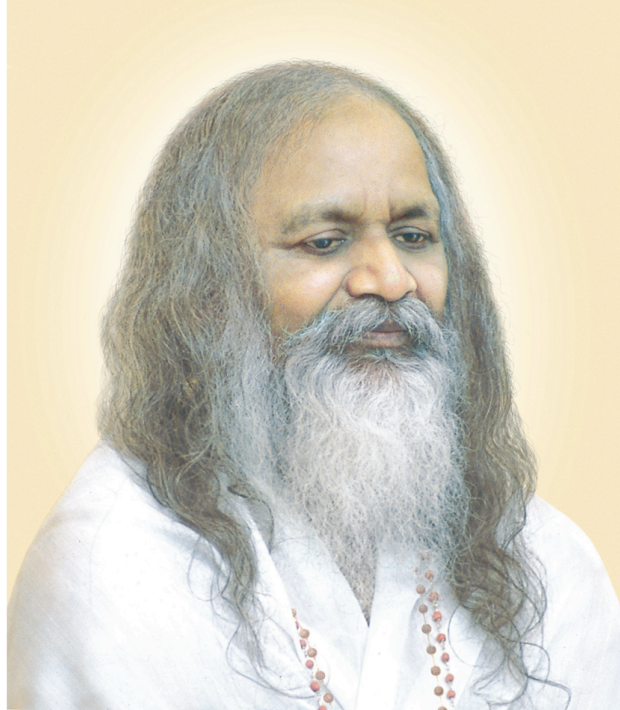
Maharishi Mahesh Yogi

Four-step Process of Creative Insight

- Preparation: study, actively thinking about or working on an idea or problem, reflection
- Incubation: silence, let go
- Illumination: sudden grasp
- Verification: justifying or proving through logical steps, also involves reflection

- KEY. Thus if we are working on a problem in class, or working on a research problem, or just listening to a proof of a theorem, the mind will take the opportunity to settle down and experience deeper levels, so that the step of illumination can take place, when we grasp the whole of whatever it was we were thinking about and integrate it into existing schemas.
- Without this habit, and without a state of relaxed alertness, when trying to solve a problem or understand a proof, we tend to try to keep thinking about it, which prevents the mind from settling to the deeper levels necessary to grasp the wholeness.
- Even trying to think about the possible wholeness does not help, because that is still holding the mind on the active level of thinking.
- The experience of wholeness occurs spontaneously when the attention is freed from thoughts and is able to go within to a deeper level of the mind.
- This is what regular experience of transcending seems to promote.

- So, whether you think of the effect of TM cognitively, as providing the ability to access the silent levels of the mind responsible for integrating new knowledge with existing schemas,
- or whether you think of the effect of TM as simply reducing the stress and anxiety in the way of having a settled mind with which to do mathematics,
- TM should be integrated into the daily routine of any math student, and indeed any math educator or math researcher.
- At MUM it is an integral part and foundation for Consciousness-Based Education. My colleague Cathy Gorini will show you how it provides the foundation for what happens in the classroom at MUM.



When the knower does not know himself, then all knowledge is baseless. And baseless knowledge can only be non-fulfilling.

Maharishi Mahesh Yogi

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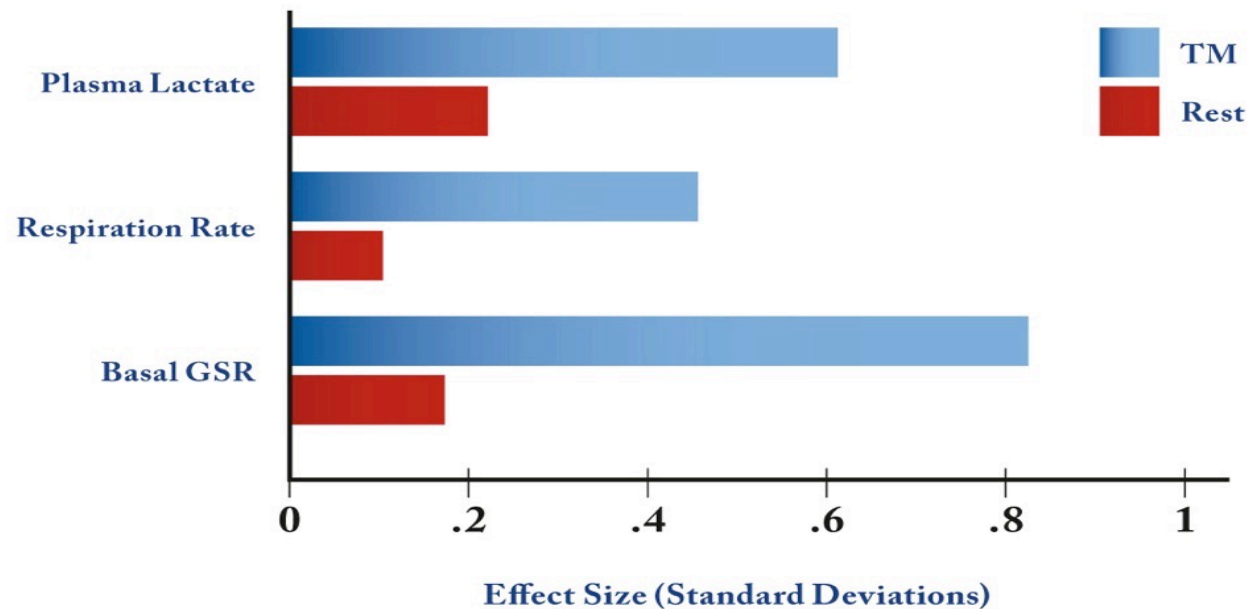
www.mum.edu

Slides in case of further questions (not
part of the talk)

Travis and Shear (2010) describe three categories of meditation and the type of brainwave activity that results: See <http://www.truthabouttm.org> (click on Comparison of Techniques)

- Focused attention (concentrating on an object or emotion) — This category includes meditations from the Tibetan Buddhist (loving kindness and compassion), Buddhist (Zen and Diamond Way), and Chinese (Qigong) traditions. These procedures are characterized by beta EEG (20-30Hz)/gamma EEG (30 – 50Hz) frequency bands, associated with mental effort. Practice increases ability to focus attention.
- Open monitoring (being mindful of one's breath or thoughts) — This category includes meditations from the Buddhist (Mindfulness, and ZaZen), Chinese (Qigong), and Vedic (Sahaja Yoga) traditions. These procedures are characterized by theta EEG (5-8Hz) and possibly gamma EEG (30-50), associated with reflecting on mental concepts. Practice increases awareness of experience and ability to be present-minded.
- Automatic self-transcending (meditations that transcend their own activity). This category includes the Transcendental Meditation® technique. Practice is characterized by alpha1 EEG (7-9Hz) associated with a relaxed state of inner awareness. Practice increases Default Mode Network activity (sense of self), more coordinated activity in different parts of the brain. Higher coherence indicates the brain's prefrontal cortex, its "CEO" or "executive control center" is functioning in an integrated manner.

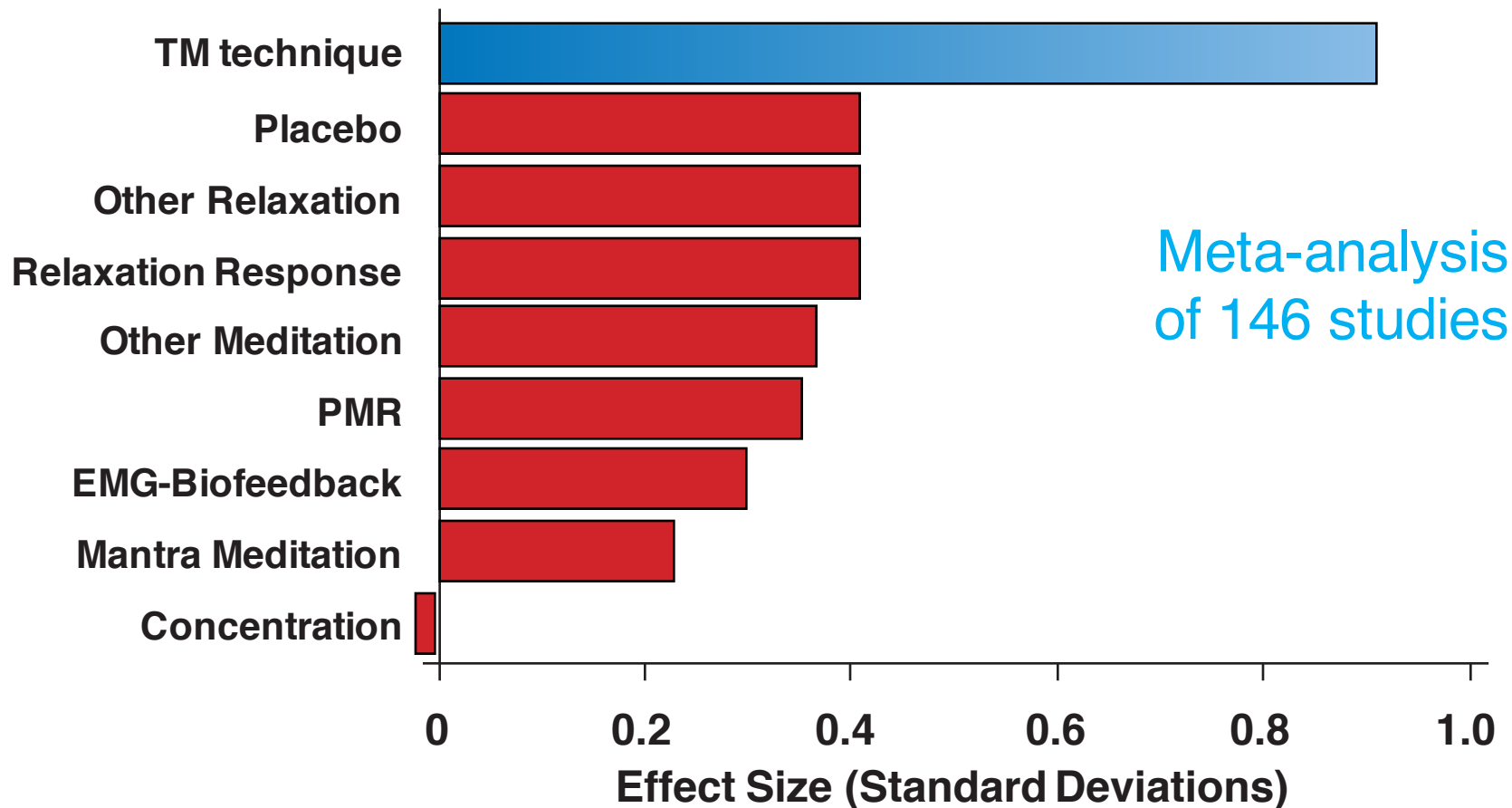
INCREASED PHYSIOLOGICAL RELAXATION Meta-Analysis 32 Studies



A meta-analysis of 32 physiological studies found that the Transcendental Meditation technique increases physiological relaxation over twice as much as ordinary rest sitting with eyes closed.

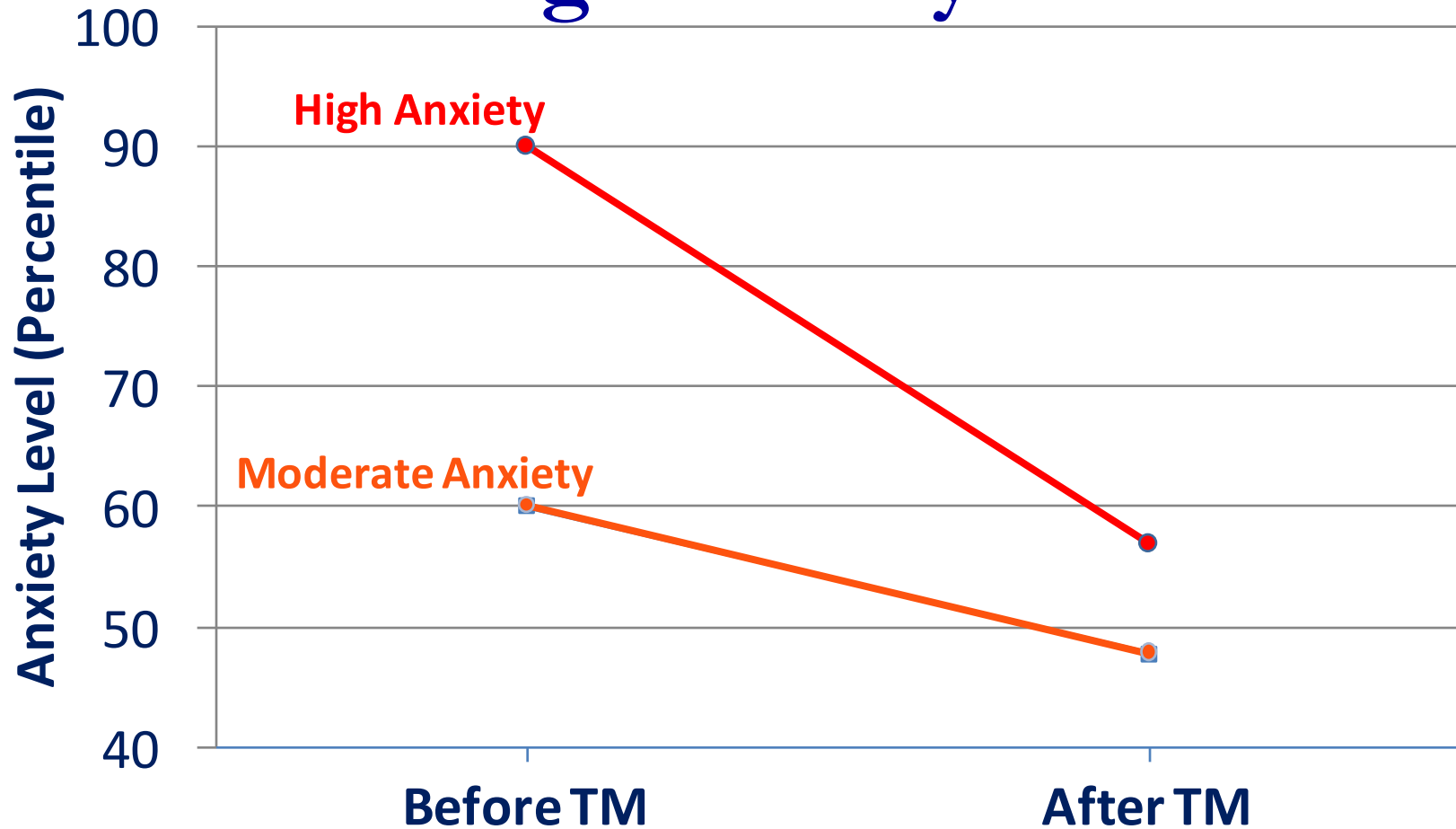
Reference: *American Psychologist* 42 (1987): 879–881.

TM: the most effective technique for reducing anxiety.



Reference. *Journal of Clinical Psychology* 45, no. 6 (1989): 957–974.

TM Most Effective for People with High Anxiety.



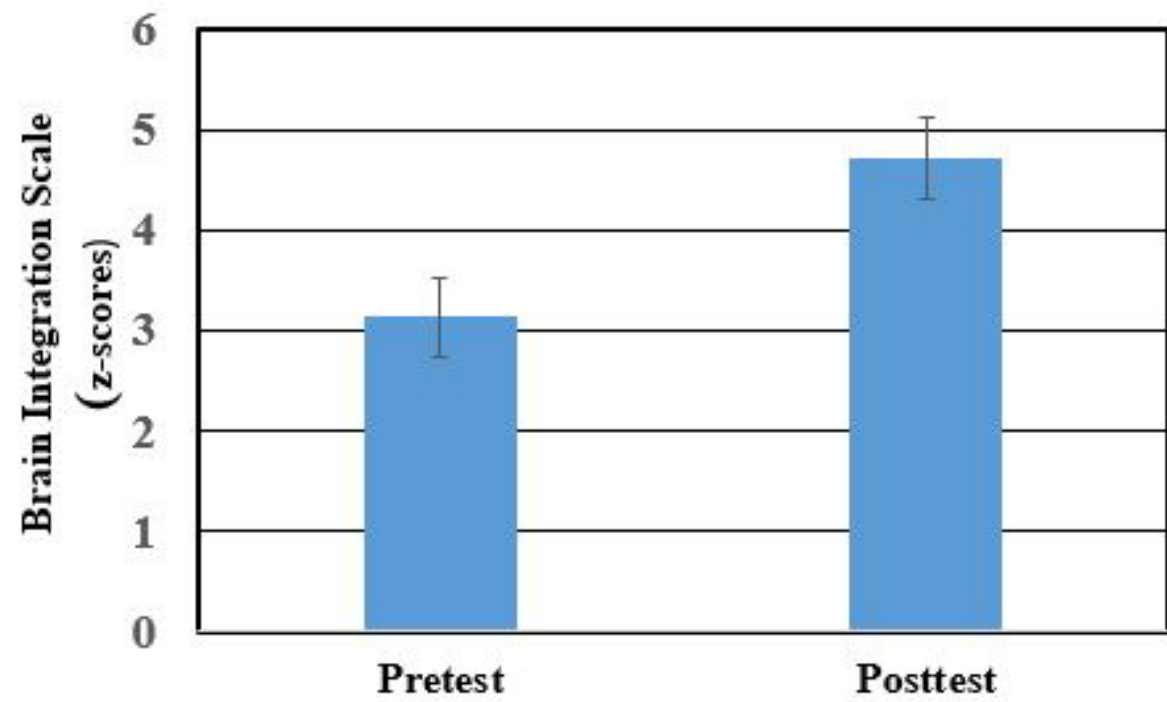
Reference: *Journal of Alternative and Complementary Medicine* 20 (2013): 330-341.

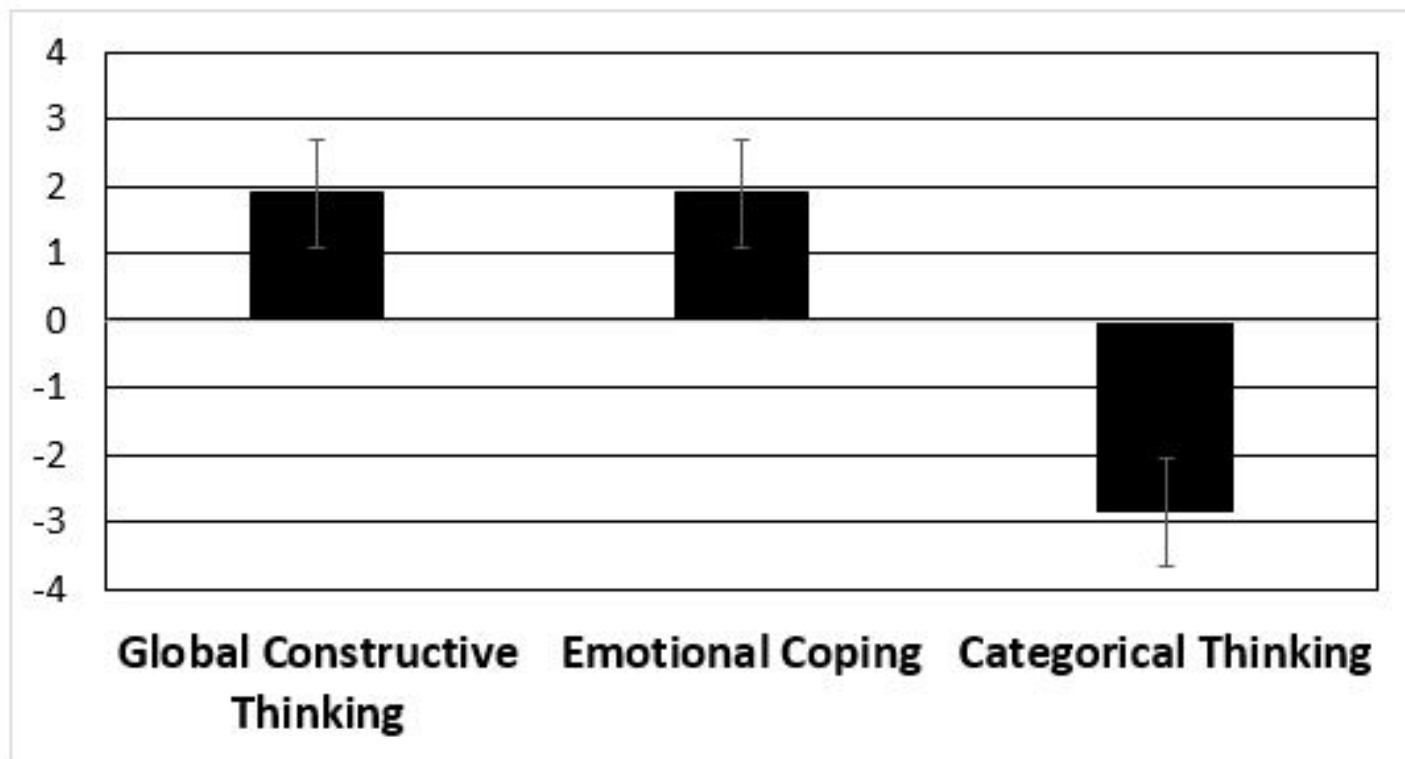
What Does the College Experience Do to Your Brain?

Travis et al: American Education Research Journal, in review

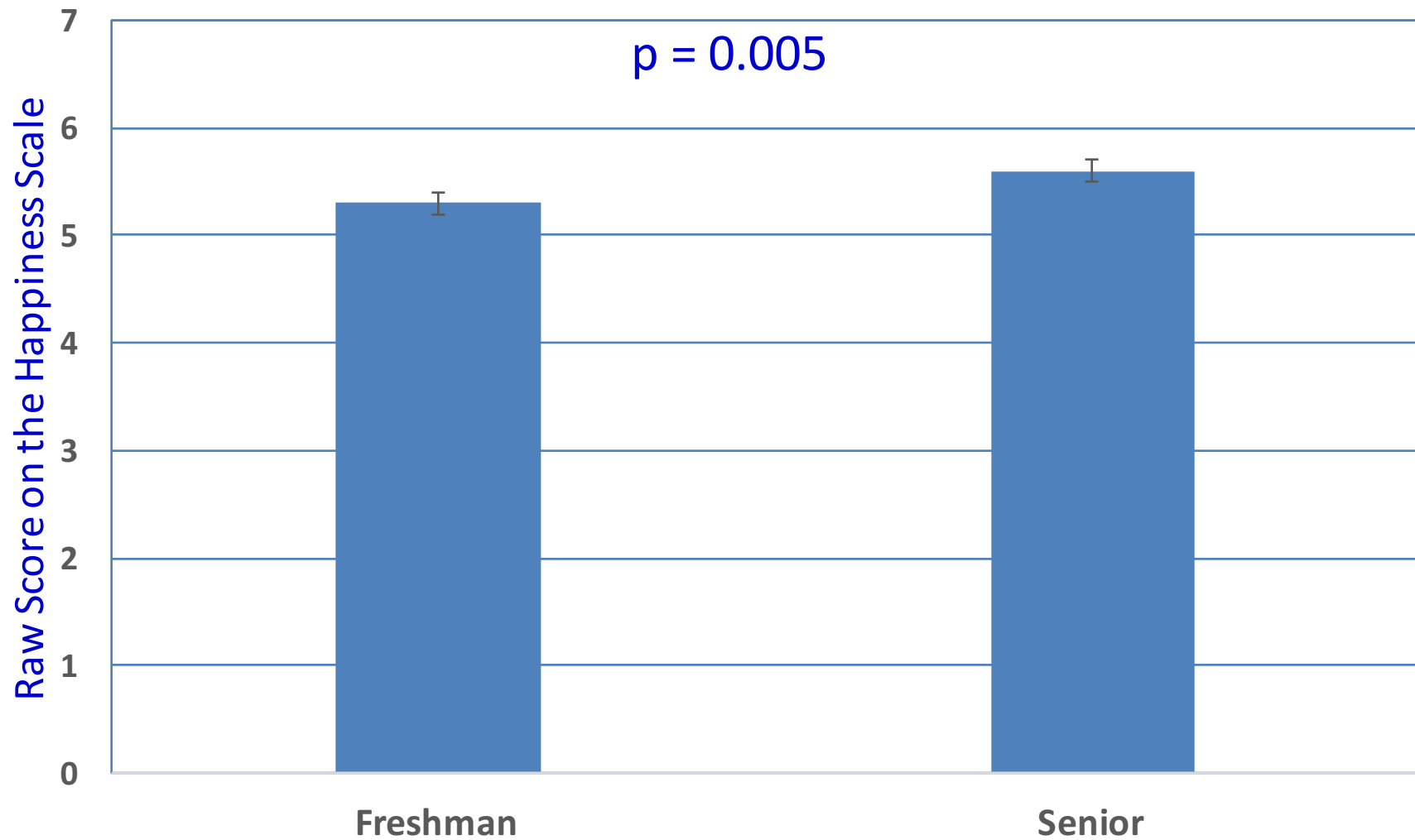
Brain integration and Constructive Thinking were compared in 27 freshman/senior pairs involved in consciousness-based education. As seniors, these subjects had higher levels of brain integration, associated with emotional stability and success in life, and higher global constructive thinking, associated with work success and stable personal and social relationships. These data broaden effects of college curriculum to include the quality of brain functioning.



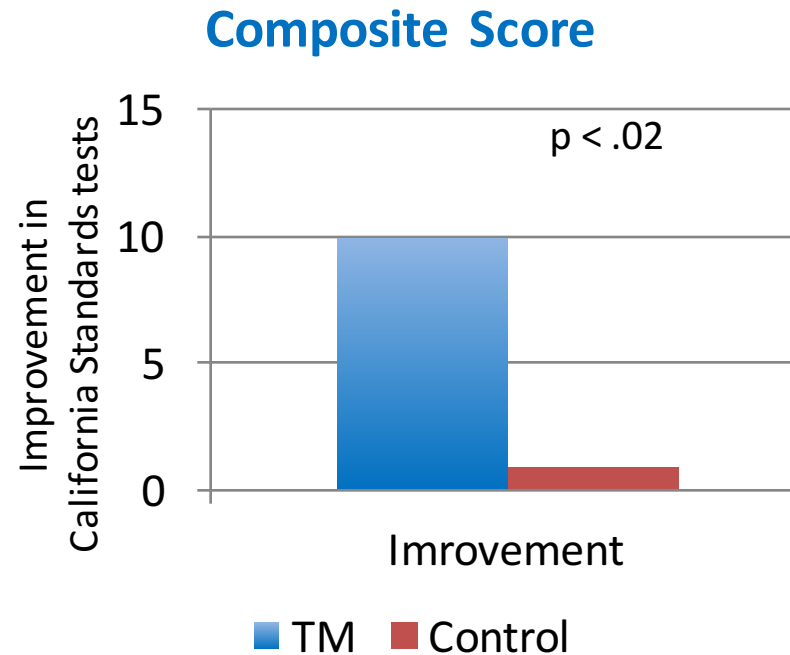




Happiness (N = 80)



Improved Academic Achievement in Students Below Basic

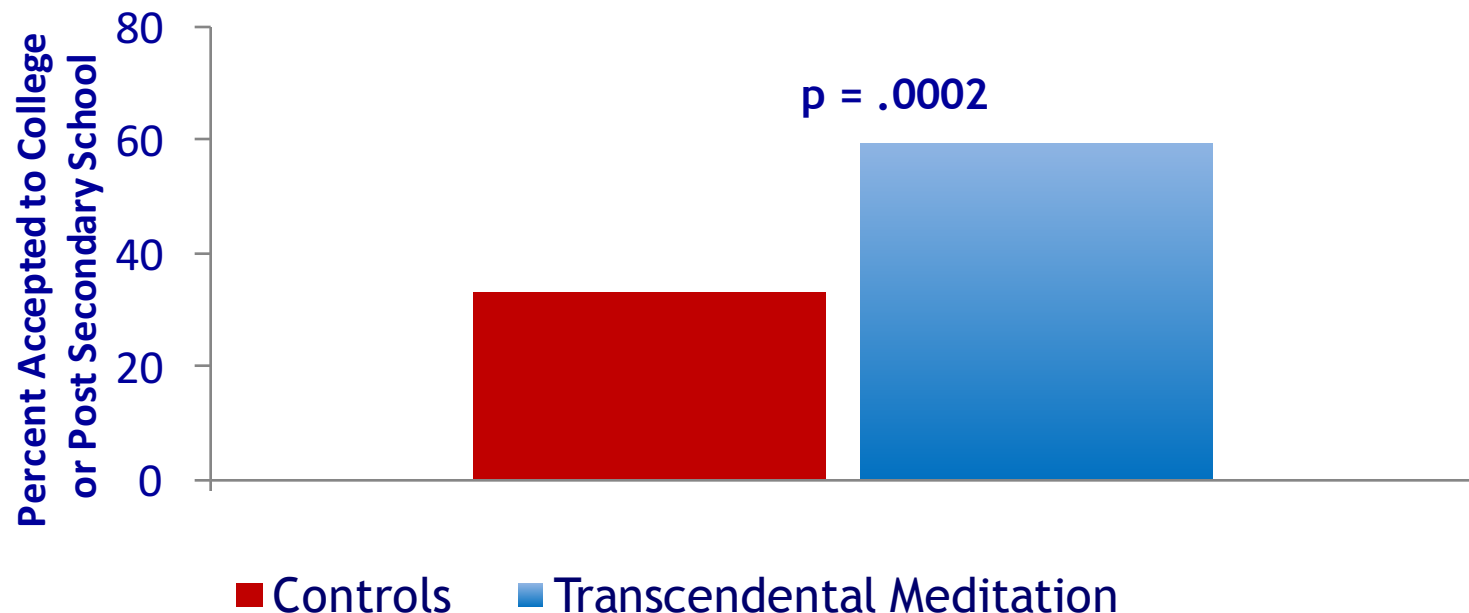


Urban middle school students who were “below basic” or “far below basic” who practiced the Transcendental Meditation technique improved 10 times as much on a composite of Math and English as those who received only the usual school curriculum.

Reference. *Education* 131, no. 3 (2011): 556-64

Increased Acceptance to College and Post Secondary School

through the *Transcendental Meditation* technique

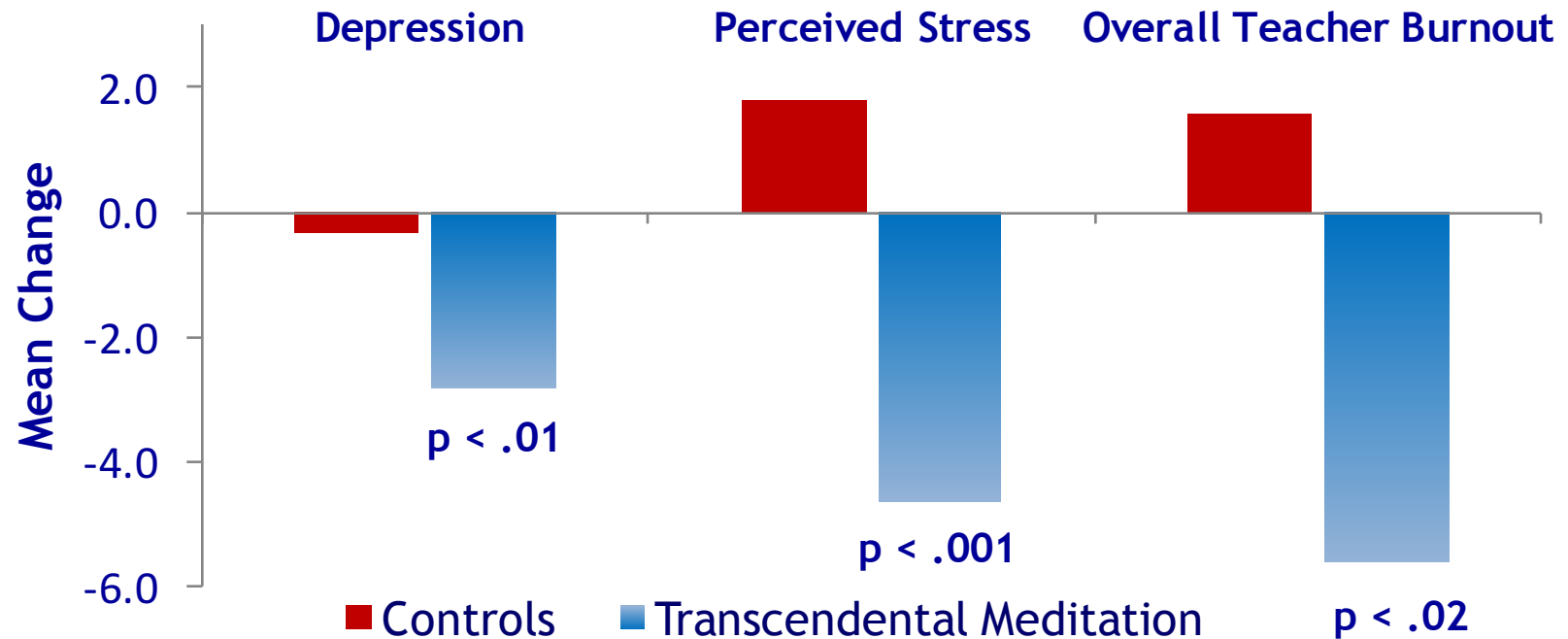


The percent of students practicing the TM technique accepted to college or post-secondary school was 59.3% compared to 33.3% for non-meditator controls.

Reference: *Education* 133(4), 495-501 (2013).

Reduced Teacher Burnout

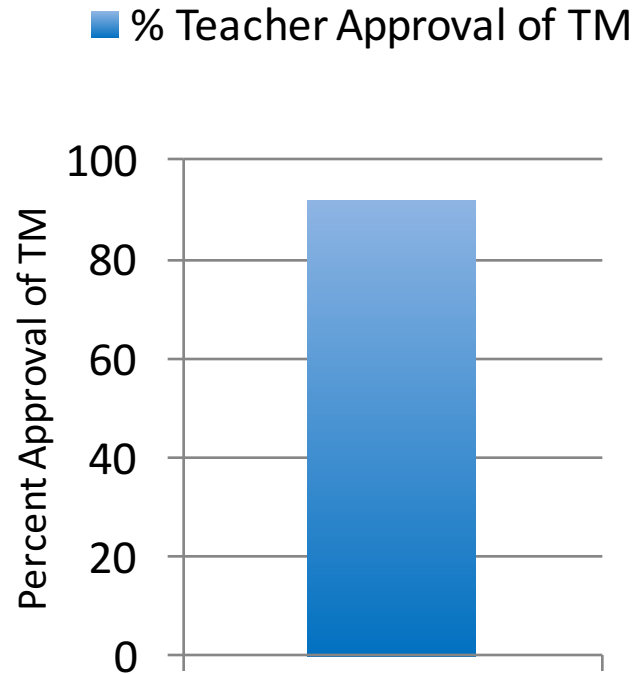
through the *Transcendental Meditation* technique



TM decreases depression, stress, and burnout in teachers.

Reference: *The Permanente Journal* 18(1), 9-23 (2014).

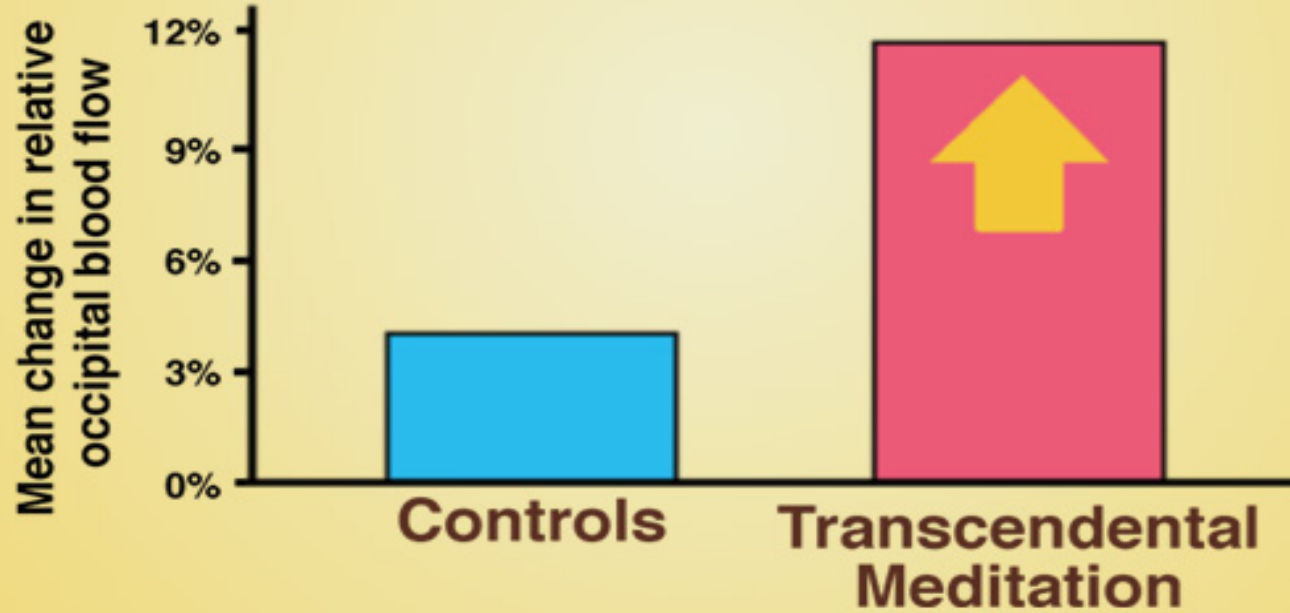
Teacher Approval of the Transcendental Meditation Technique



Ninety-two percent of the faculty surveyed reported that they felt the Transcendental Meditation program was valuable for the school. They felt that the students were:

- calmer,
- happier,
- less hyperactive,
- friendlier,
- and had an increased ability to focus on schoolwork.

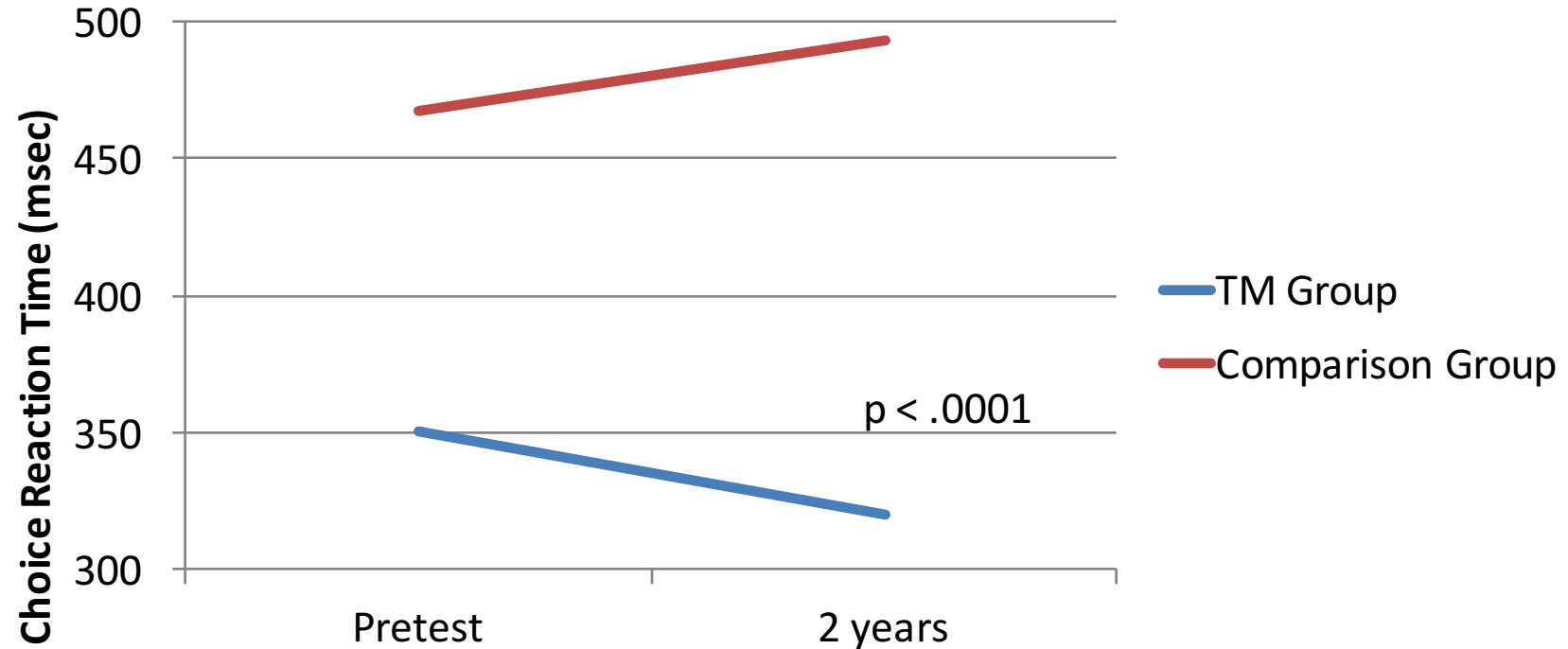
Increased Blood Flow to the Brain THROUGH TRANSCENDENTAL MEDITATION



Reference: *Physiology & Behavior* 59: 399–402, 1996.

Decreased Choice Reaction Time

through the *Transcendental Meditation* technique

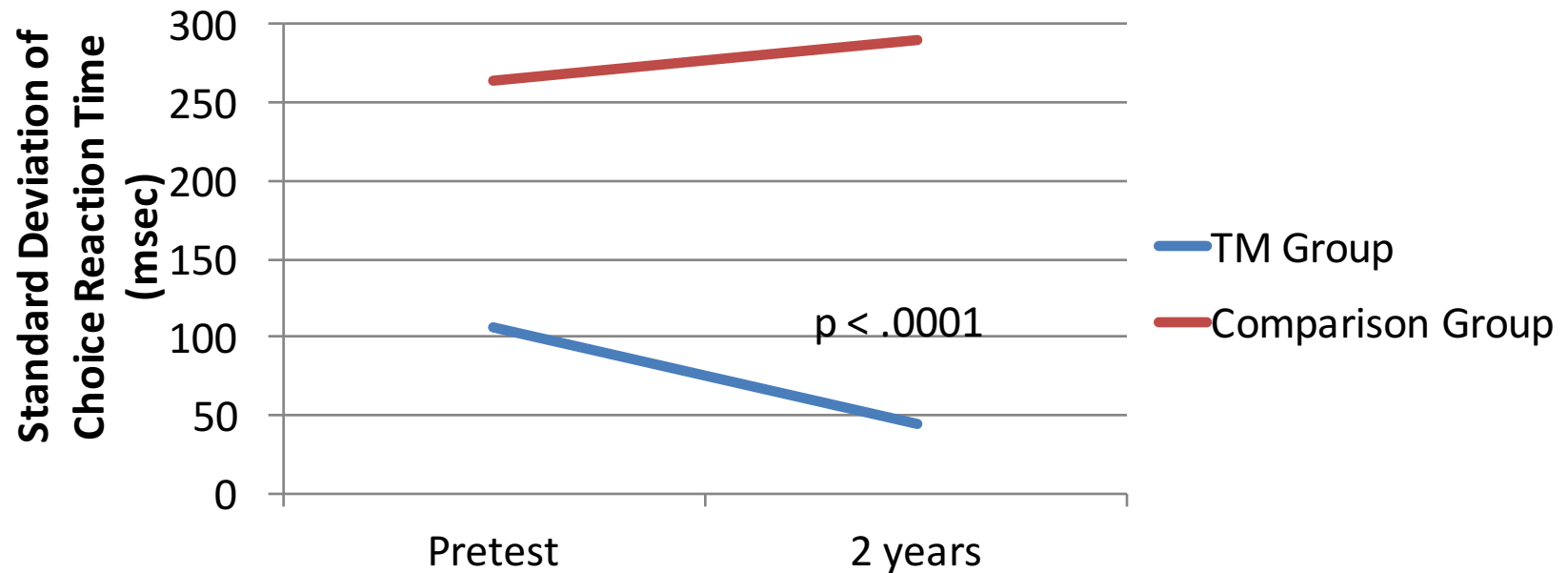


The TM group started at a much faster level of choice reaction time and improved further after two years of TM practice, whereas the comparison group tended to get slower after two years.

Personality and Individual Differences 12 (1991): 1105-16.

Reduced Wavering of Attention: Reduced Noise in the Nervous System

through the *Transcendental Meditation* technique

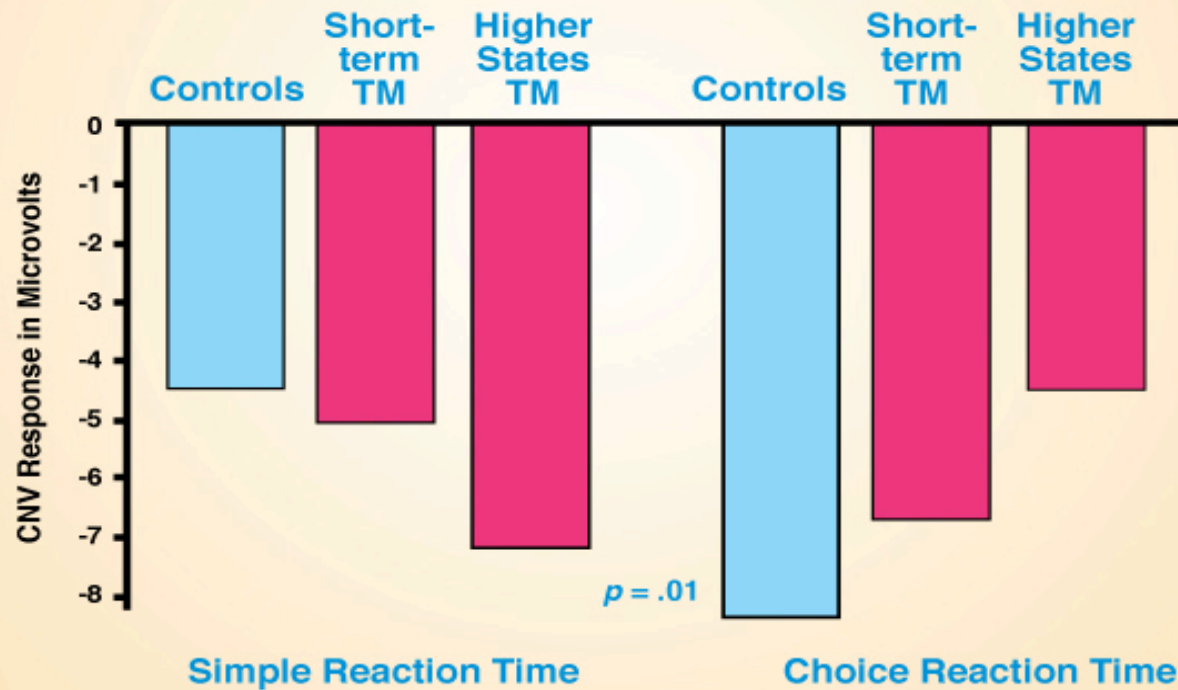


Wavering of attention, measured by variability in choice reaction time, was less in the TM group and improved even further after two more years of TM practice. The comparison group tended to get worse.

Reference: *Personality and Individual Differences* 12 (1991): 1105-16.

Greater Efficiency of Brain Processing

THROUGH TRANSCENDENTAL MEDITATION



Reference: *Biological Psychology* 61: 293–319, 2002.